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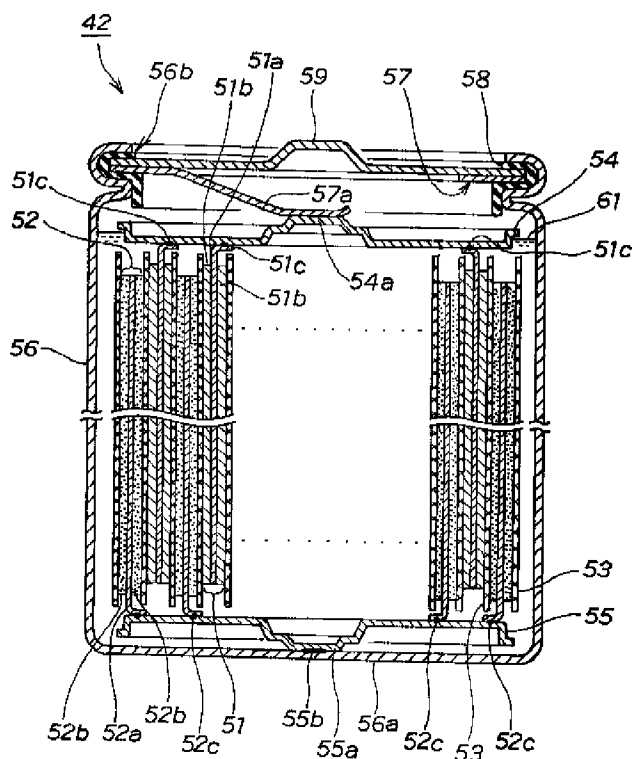
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**要約****(57)【要約】****【解決手段】**正・負電極板51, 52の一辺に、活物質51b, 52bを塗布しない未塗装部分51d, 52dを設け、この未塗装部分51d, 52dを正・負極端子54, 55にレーザ溶接した。**【効果】**レーザ溶接によって、正・負電極板にそれぞれ正・負極端子を確実に結合することができる。また、正・負電極板と正・負極端子との結合部の電気抵抗をより小さくすることができる。**請求の範囲**

**【特許請求の範囲】**

【請求項1】 ケース内に電解液とともに収納した正・負電極板に、正・負極端子を結合する形式の蓄電素子において、前記正・負電極板の一辺に、活物質を塗布しない未塗装部分を設け、この未塗装部分を正・負極端子にレーザ溶接したことを特徴とする蓄電素子。

【請求項2】 前記正・負極端子に前記正・負電極板の端部を挿入する溝を形成したことを特徴とする請求項1記載の蓄電素子。


【請求項3】 前記正・負電極板を重ねてロール状にし、このロール状電極板の端部に前記正・負極端子をレーザ溶接したことを特徴とする請求項1又は請求項2記載の蓄電素子。

**詳細な説明****【発明の詳細な説明】****【0001】**

【発明の属する技術分野】本発明は蓄電素子の改良に関する。

**【0002】**

【従来の技術】本発明者らは、先に特願平9-103050号「蓄電素子」で蓄電素子の正・負極板の一辺に活物質を塗装しない未塗装部分を設け、この未塗装部分に正・負極端子を当てることにより組立てて、生産性を向上させ、且つ正・負極板と正・負極端子との接触面積を増すことで接触抵抗を小さくする技術を提案した。この技術を次図で説明する。

【0003】12は正・負極板の未塗装部分に正・負極端子を当てた従来の蓄電素子の断面図であり、蓄電素子100は、それぞれ両面に活物質を塗布した正電極板101及び負電極板102と、これら正・負電極板101、102との間に設けたセパレータ103、103と、正電極板101の上部に当てた正極端子である集電板104と、負電極板102の下部に当てた負極端子である集電板105と、これら正・負電極板101、102、セパレータ103、103及び集電板104、105を収納する導電性のあるケース106と、このケース106の底部にこれら正・負電極板101、102、セパレータ103、103及び集電板104、105を押し付ける導電板107と、ケース106の開口部に導電板107とともにガasket108を介してかした蓋109と、ケース106内に注入した電解液111とからなる。

**【0004】**

【発明が解決しようとする課題】上記技術は、集電板105に負電極板102を押当て、正電極板101に集電板104を押当てることで電力を外部へ取出すものである。近年、ハイブリッド車、電気自動車、電動自転車等の需要により、蓄電素子に対する更なる小型化、軽量化並びに大容量化が求められ、より効率的に電力を取出すために、例えば蓄電素子の内部抵抗の低減が望まれる。また、前述の車両では、複数の蓄電素子を使用するために、それぞれの蓄電素子の安定した品質も要求される。そこで、本発明の目的は、内部抵抗をより低減し、信頼性を向上させた蓄電素子を提供することにある。


**【0005】**

【課題を解決するための手段】上記目的を達成するために本発明の請求項1は、ケース内に電解液とともに収納した正・負電極板に、正・負極端子を結合する形式の蓄電素子において、正・負電極板の一辺に、活物質を塗布しない未塗装部分を設け、この未塗装部分を正・負極端子にレーザ溶接した。レーザ溶接によって、正・負電極板にそれぞれ正・負極端子を確実に結合する。また、正・負電極板と正・負極端子との結合部の電気抵抗がより小さくなる。

【0006】請求項2は、正・負極端子に正・負電極板の端部を挿入する溝を形成した。正・負電極板と正・負極端子との結合部の面積が大きくなり、結合部の電気抵抗がより小さくなる。

【0007】請求項3は、正・負電極板を重ねてロール状にし、このロール状電極板の端部に正・負極端子をレーザ溶接した。正・負極端子が正・負電極板の未塗装部分に均等に接触するため、レーザ溶接による結合がより確実になり、正・負電極板と正・負極端子との結合部の電気抵抗がより小さくなる。

**【0008】**

【発明の実施の形態】本発明の実施の形態を添付図に基づいて以下に説明する。なお、図面は符号の向きに見るものとする。1は本発明に係るペダル付き電動自転車の側面図であり、ペダル付き電動自転車1は、フレーム2と、このフレーム2の前部に取付けたヘッドパイプ4と、このヘッドパイプ4に回転可能に取



付けた上部のハンドルポスト5及び下部のフロントフォーク6と、ハンドルポスト5にハンドルラッグ7で取付けたハンドルバー8と、フロントフォーク6の下端に回転可能に取付けた前輪11と、フレーム2の後端に取付けた後輪12とからなる。


【0009】フレーム2は、ヘッドパイプ4の後ろ下方に延びるダウンフレーム14と、このダウンフレーム14の後端から立上げた図示せぬシートポストと、上記ダウンフレーム14の後端から後方に延ばしたりヤフォーク15と、これらシートポスト及びりヤフォーク15後端に掛け渡したりヤサブフォーク16とからなる。

【0010】ダウンフレーム14は、バッテリー17を着脱可能に取付け、後端部に駆動部18を設けたものである。りヤフォーク15は、後端に後輪12及びチェーン sprocket 21を回転可能に取付けるものである。

【0011】駆動部18は、電動モータ22と、この電動モータ22で駆動する駆動ギヤ23と、この駆動ギヤ23に取付けたペダル24、24(奥は省略)とからなる。電動モータ22は、バッテリー17、図示せぬ回転・トルク制御装置に接続し、人がペダル24、24を踏むと、これに反応して、回転してトルクを発生させ、踏力をアシストするものである。

【0012】駆動ギヤ23は、チェーン25を介してチェーン sprocket 21に駆動力を伝え、後輪12を回転させるものである。ここで、26はフロントブレーキ、27はカゴ、28は前輪11の泥よけ、31はシートポストに取付けたパイプ、32はシート、33はチェーンカバー、34はりヤブレーキ、35は後輪12の泥よけ、36はスタンドである。


【0013】2は本発明に係るバッテリーの斜視図であり、バッテリー17は、収納ケース41と、この収納ケース41内に複数個を直列接続した蓄電素子としてのバッテリーセル42…(…は複数個を示す。以下同様。)と、これらバッテリーセル42…を電動モータ22(参照)に接続するためのコネクタ43と、これらバッテリーセル42…及び電動モータ22間の過電流を防止するためのヒューズ44と、バッテリーセル42…を家庭用電源で充電するための充電コンセント45とからなる。なお、46は取っ手である。


【0014】3は本発明に係るバッテリーセルを示す断面図(第1の実施の形態)であり、バッテリーセル42は、正電極板51と、負電極板52と、これら正・負電極板51、52との間に設けたセパレータ53、53と、正電極板51の上部にレーザ溶接した正極端子としての集電板54と、負電極板52の下部にレーザ溶接した負極端子としての集電板55と、これら正・負電極板51、52、セパレータ53、53及び集電板54、55を収納する導電性のあるケース56と、このケース56の底部56a側にこれら正・負電極板51、52、セパレータ53、53及び集電板54、55を押し付けるための弾性部材である導電板57と、ケース56の上部の開口部56bに導電板57とともにガスケット58を介してかした蓋59と、ケース56内に注入した電解液61とからなる。




【0015】正電極板51は、正電極箔51aと、この正電極箔51aの両面に塗布した活物質51b、51bとからなる。なお、51c…は正電極箔51aと集電板54との溶接部である。負電極板52は、負電極箔52aと、この負電極箔52aの両面に塗布した活物質52b、52bとからなる。なお、52c…は負電極箔52aと集電板55との溶接部である。

【0016】セパレータ53は、正電極板51と負電極板52とを絶縁するものである。集電板54、55は、同一のもので、それぞれ上下逆に組込んだものであるが、説明の都合上符号を変えた。

【0017】このように、正極側と負極側とで共通の集電板54、55を用いることで、部品の種類を減らすことができ、製造コストを抑えることができる。導電板57は、組付時にたわませることで押圧力を発生させる押圧部57aを有する。ここで、負極側の集電板55を用いずに、ケース56に負電極板52をレーザ溶接してもよい。

【0018】4は本発明に係るバッテリーセルを示す分解斜視図(第1の実施の形態)であり、ケース56に、円板状の集電板55と、正電極板51の外側にセパレータ53、セパレータ53の外側に負電極板52、負電極板52の外側にセパレータ53を重ねて巻いたロール状電極板としての電極アセンブリ62と、円板状の集電板54とをこの順に挿入し、ケース56の上端の開口部56bにガスケット58に設けた小径部58aを挿入し、ガスケット58に設けた大径部58bの内面に導電板57及び蓋59を挿入することを示す。

【0019】バッテリーセル42は、ケース56の開口部56bに導電板57及び蓋59を挿入した後、3に示したように、ケース56を径内方へ絞り、ケース56の上部を密閉したものである。集電板54、55は、中央に凸部54a、55aを形成したものである。

【0020】凸部54aは、導電板57の押圧部57aに接触する部分である。凸部55aは、ケース56の底部56a()にレーザ溶接する部分である。( 3に示した55bが溶接部である。)なお、凸部55aと底部56aとの結合は、他の溶接方法で行ってもよい。ケース56は、底部56a()を除いて外面を電

氣的に絶縁処理したものである。

【0021】図5は本発明に係る電極板を説明する図であり、正電極板51は、正電極箔51aの一边を除いて、活物質51bを塗布したものであり、未塗装部分51d、51d(裏側の51dは不図示)は、正電極板51の上部一边に一定の幅に確保したものである。

【0022】負電極板52は、負電極箔52aの一边を除いて、活物質52bを塗布したものであり、未塗装部分52d、52d(裏側の52dは不図示)は、負電極板52の下部一边に一定の幅に確保したものである。これらの未塗装部分51d、51d、52d、52dは、活物質51b、52bを塗布した部分に比べて導電性がよい。

【0023】これらの正電極板51及び負電極板52を、セパレータ53を介して活物質51b、52b部分が重なるように巻き、未塗装部分51d、52dをロール状の電極アセンブリ62の端部から突出させ、ケース56(図4参照)に収納する。

【0024】上記したように、正・負電極板51、52を重ねてロール状の電極アセンブリ62にしたことで、電極アセンブリ62の端部に集電板54、55(図3参照)を均等に接触させてからレーザ溶接ができるため、レーザ溶接による結合をより確実にすることができ、正・負電極板51、52と集電板54、55との結合部の電気抵抗をより小さくすることができる。従って、バッテリーセル42(図3参照)の内部抵抗をより小さくすることができる。

【0025】図6(a)～(d)は本発明に係る集電板の平面図であり、集電板と正・負電極板とのレーザ溶接の形態を複数の例で示したものである。(a)は、集電板54の凸部54a(又は集電板55の凸部55a)を除いて一直線状にレーザ溶接したものである。(b)は、凸部54a(又は凸部55a)を除いて十字状にレーザ溶接したものである。

【0026】(c)は、凸部54a(又は凸部55a)を除いて60°等間隔にレーザ溶接したものである。(d)は、凸部54a(又は凸部55a)を除いて45°等間隔にレーザ溶接したものである。

【0027】図7は本発明に係る正・負電極板と集電板とのレーザ溶接の方法を説明する断面図である。正電極板51に集電板54をレーザ溶接するには、まず、電極アセンブリ62の端部に集電板54を押付け、正電極板51と集電板54との接触部の高さ位置Pにレーザ溶接装置LのレーザビームBの焦点を合せ、電極アセンブリ62の外周側から内周側へレーザ溶接装置Lを移動しながら溶接を行う。

【0028】レーザ溶接装置Lが集電板54の凸部54a部に差掛かったら、一端レーザビームBの照射を止め、凸部54a部を通り過ぎたら再びレーザビームBの照射を始めて、電極アセンブリ62の内周側から外周側へレーザ溶接装置Lを移動しながら溶接を行う。負電極板52に集電板55をレーザ溶接する場合も同様に行う。

【0029】図8は本発明に係る電極アセンブリの製造工程のフロー図(第1の実施の形態)である。なお、ST××はステップ番号を示す。(符号は図3及び図5参照)

ST01……正・負電極板51、52用の活物質51b、52bを混練する。

ST02……ST01で混練した活物質51b、52bをスラリー状にし、正・負電極箔51a、52aに塗布する。ただし、前述の未塗装部分51d、52dを設ける。

【0030】ST03……正・負電極板51、52を正規寸法にカットする。

ST04……正・負電極板51、52をプレスして、活物質51b、52bを含めた厚さを一定にする。

ST05……正・負電極板51、52を巻き取り、電極アセンブリ62を作製する。

ST06……負電極板52に集電板55をレーザ溶接する。

ST07……電極アセンブリ62及び集電板55をケース56に挿入する。

【0031】ST08……ケース56に集電板55をレーザ溶接する。

ST09……ケース56内に電解液61を注入する。

ST10……正電極板51に集電板54をレーザ溶接する。

ST11……ケース56内にガスケット58を介して導電板57及び蓋59を挿入する。

ST12……ケース56に導電板57及び蓋59を加締める。

【0032】図9(a)～(c)は集電板の変形例を説明する説明図(第2の実施の形態)であり、(a)は斜視図、(b)は(a)のb-b線断面図、(c)はレーザ溶接の方法を説明する断面図である。なお、第1の実施の形態と同一構成については説明を省略する。(a)において、集電板64は、正・負電極板51、52(図5参照)の端部である未塗装部分51d、52d(図5参照)を挿入する螺旋溝64aを形成したものである。(b)において、螺旋溝64aは、集電板64に切削加工、プレス加工等により形成したものであり、その幅は、正・負電極板51、52(図5参照)の正・負電極箔51a、52aが挿入できるものである。

【0033】(c)において、正電極板51に集電板64をレーザ溶接するには、まず、正電極板51の端部を集電板64の螺旋溝64aの溝底64bまで挿入し、正電極板51と集電板64との接触部、即ち螺旋溝64aの溝底64b(この高さ位置をQとする。)にレーザ溶接装置LのレーザビームBの焦点を合せ、集電板64の外周側から内周側へレーザ溶接装置Lを移動しながら溶接を行う。

【0034】レーザ溶接装置Lが集電板64の凸部64c部に差掛かったら、一端レーザビームBの照射を止め、凸部64c部を通り過ぎたら再びレーザビームBの照射を始めて、集電板64の内周側から外周側へレーザ溶接装置Lを移動しながら溶接を行う。負電極板52に集電板64をレーザ溶接する場合も同様に行う。ここで、例えば、レーザ溶接装置Lを移動中に正電極板51近傍の長さdのみを断続的にレーザ溶接してもよい。これにより、レーザ溶接により発生する熱の影響を少なくすることができる。

【0035】上記したように、集電板64に正・負電極板51、52(図5参照)の端部を挿入する螺旋溝64aを形成したことで、正・負電極板51、52と集電板64との結合部の面積を大きくすることができ、結合部の電気抵抗をより小さくすることができる。

【0036】図10(a)、(b)は本発明に係る集電板の別の変形例を説明する説明図(第3の実施の形態)であり、(a)は斜視図、(b)はバッテリーセルに集電板を組込んだ状態を示す断面図である。なお、第1の実施の形態と同一構成については説明を省略する。(a)において、集電板65は、蓋59(図4参照)に結合するための起立部65aを形成したものである。(b)において、バッテリーセル66は、電極アセンブリ62の正電極板51に集電板65をレーザ溶接し、集電板65に蓋59をレーザ溶接したものである。(51c…((a)参照)), 65bは溶接部である。)

なお、集電板65と蓋59との結合は、他の溶接方法で行ってもよい。

【0037】これにより、ケース56と集電板55(図3参照)、集電板55と負電極板52(図3参照)、正電極板51と集電板65、集電板65と蓋59がそれぞれ溶接によって結合するため、結合部の電気抵抗をより小さくことができ、バッテリーセル66の内部抵抗をより低減することができる。

【0038】図11は本発明に係るバッテリーセルを示す断面図(第4の実施の形態)であり、第1の実施の形態と同一構成については説明を省略する。バッテリーセル70は、正電極板51の上部にレーザ溶接した正極端子としての集電板71と、負電極板52の下部にレーザ溶接した負極端子としての集電板72と、正・負電極板51、52、セパレータ53、53及び集電板71、72を収納する電気絶縁性のあるケース73とからなる。

【0039】電極アセンブリ62は、電解液61(図示せず)を含浸させたものである。集電板71は、円板状部71aと、この円板状部71aの中央に取付けた端子部71bとからなる。集電板72は、集電板71と同一形状であり、円板状部72aと、この円板状部72aの中央に取付けた端子部72bとからなる。ケース73は、ケース本体73aと、このケース本体73aの開口部を塞ぐ蓋部材73bとからなる。なお、73c、73cは挿入孔である。

【0040】バッテリーセル70を組立するには、電極アセンブリ62に集電板71、72をレーザ溶接し、ケース本体73aの挿入孔73cに集電板72の端子部72bを圧入して、ケース本体73aに電極アセンブリ62及び集電板71、72を収納し、蓋部材73bの挿入孔73cに集電板71の端子部71bを圧入するとともにケース本体73aに蓋部材73bを溶着する。

【0041】尚、本発明の実施の形態では、正・負電極板51、52に集電板54、55(図3参照)、64(図9参照)、65(図10参照)、71、72をレーザ溶接したが、これに限るものではなく、抵抗溶接、電子ビーム溶接でもよい。また、本発明のバッテリーセル42(図3参照)、66(図10参照)、70における正・負電極板51、52と集電板54、55、64、65、71、72との結合は、リチウムイオン電池、鉛電池、ニッケルカドミウム電池、ニッケル水素電池等の二次電池や電気二重層コンデンサ、アルミ箔形電解コンデンサに適用できる。

【0042】

【発明の効果】本発明は上記構成により次の効果を発揮する。請求項1の蓄電素子は、正・負電極板にそれぞれ正・負極端子をレーザ溶接したので、レーザ溶接によって、正・負電極板に正・負極端子を確実に結合することができ、信頼性を向上させることができる。また、正・負電極板と正・負極端子との結合部の電気抵抗をより小さくすることができ、蓄電素子の内部抵抗をより低減することができる。

【0043】請求項2の蓄電素子は、正・負極端子に正・負電極板の端部を挿入する溝を形成したので、正・負電極板と正・負極端子との結合部の面積を大きくすることができ、結合部の電気抵抗をより小さくすることができ、蓄電素子の内部抵抗をより低減することができる。

【0044】請求項3の蓄電素子は、正・負電極板を重ねてロール状電極板にしたので、ロール状電極板の端部に正・負極端子を均等に接触させてからレーザ溶接することができるため、レーザ溶接による結合を

より確実にすることができ、安定した品質を得ることができる。また、正・負電極板と正・負極端子との結合部の電気抵抗をより小さくすることができ、蓄電素子の内部抵抗をより低減することができる。

## 図の説明

### 【図面の簡単な説明】

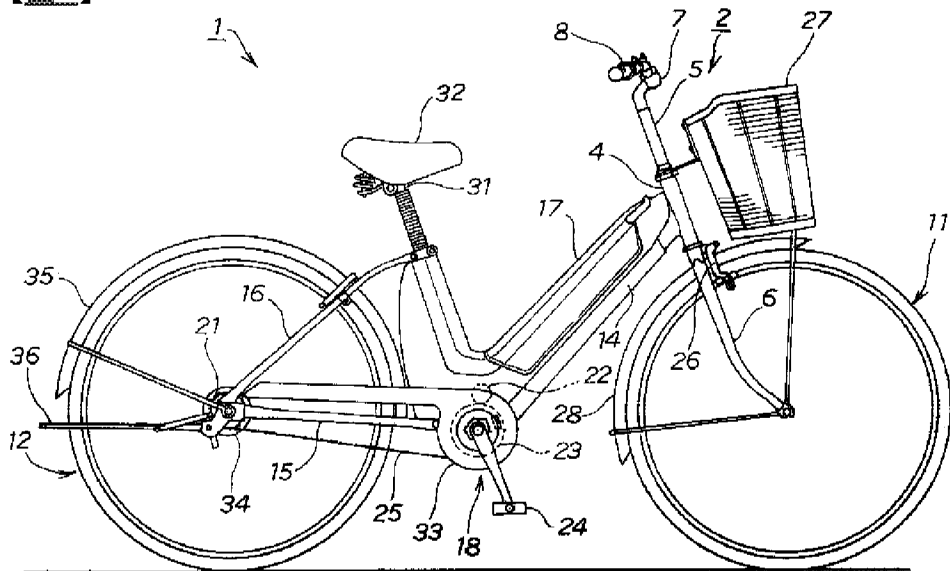
- 【図1】本発明に係るペダル付き電動自転車の側面図
- 【図2】本発明に係るバッテリーの斜視図
- 【図3】本発明に係るバッテリーセルを示す断面図（第1の実施の形態）
- 【図4】本発明に係るバッテリーセルを示す分解斜視図（第1の実施の形態）
- 【図5】本発明に係る電極板を説明する図
- 【図6】本発明に係る集電板の平面図
- 【図7】本発明に係る正・負電極板と集電板とのレーザ溶接の方法を説明する断面図
- 【図8】本発明に係る電極アセンブリの製造工程のフロー図（第1の実施の形態）
- 【図9】集電板の変形例を説明する説明図（第2の実施の形態）
- 【図10】本発明に係る集電板の別の変形例を説明する説明図（第3の実施の形態）
- 【図11】本発明に係るバッテリーセルを示す断面図（第4の実施の形態）
- 【図12】正・負極板の未塗装部分に正・負極端子を当てた従来の蓄電素子の断面図

### 【符号の説明】

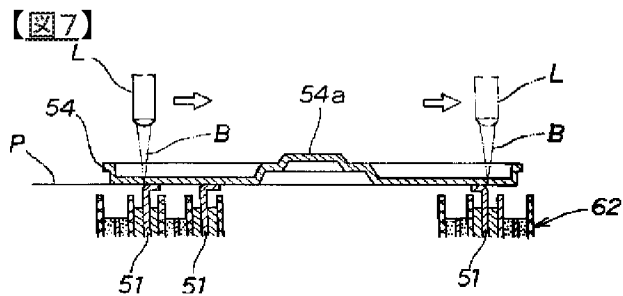
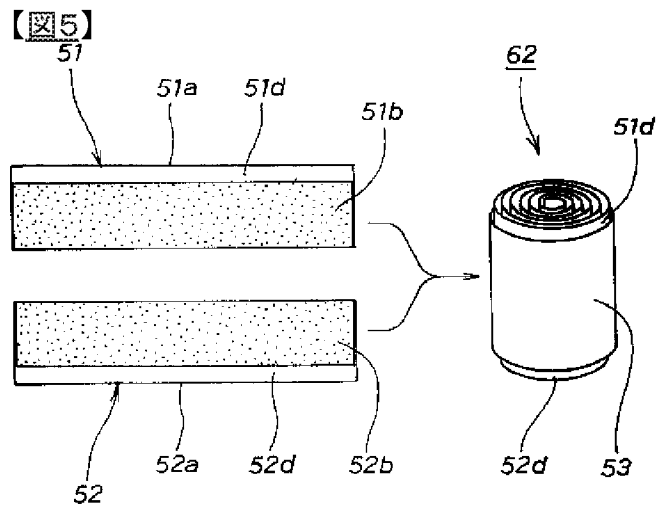
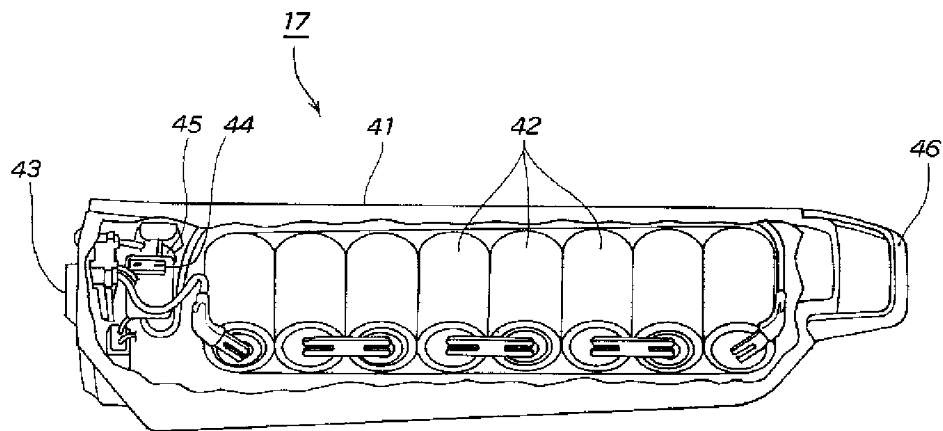
42, 66, 70…蓄電素子（バッテリーセル）、51…正電極板、51b, 52b…活物質、51d, 52d…未塗装部分、52…負電極板、54, 64, 65, 71…正極端子（集電板）、55, 64, 72…負極端子（集電板）、56, 73…ケース、62…ロール状電極板（電極アセンブリ）、64a…溝（螺旋溝）。

## 図面

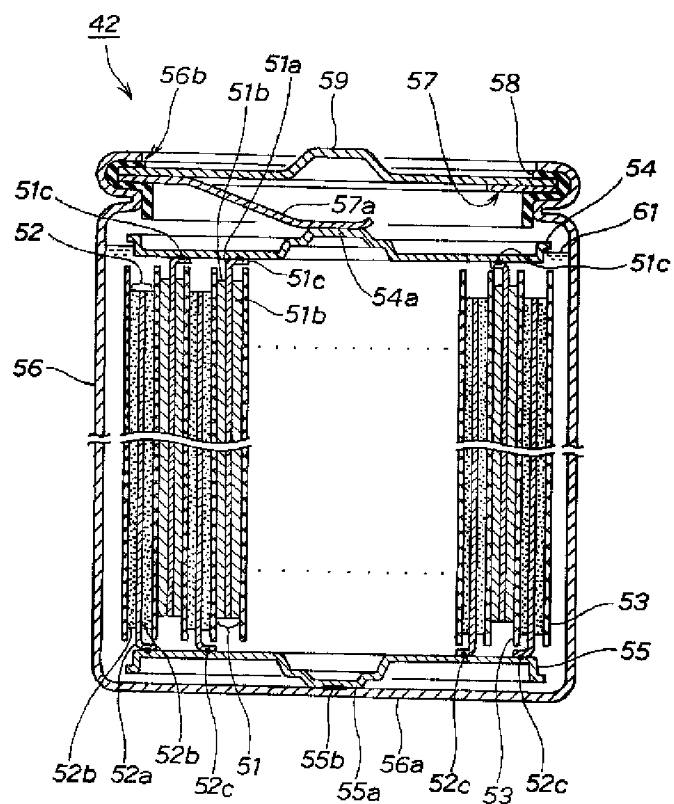
### 【図1】



### 【図2】

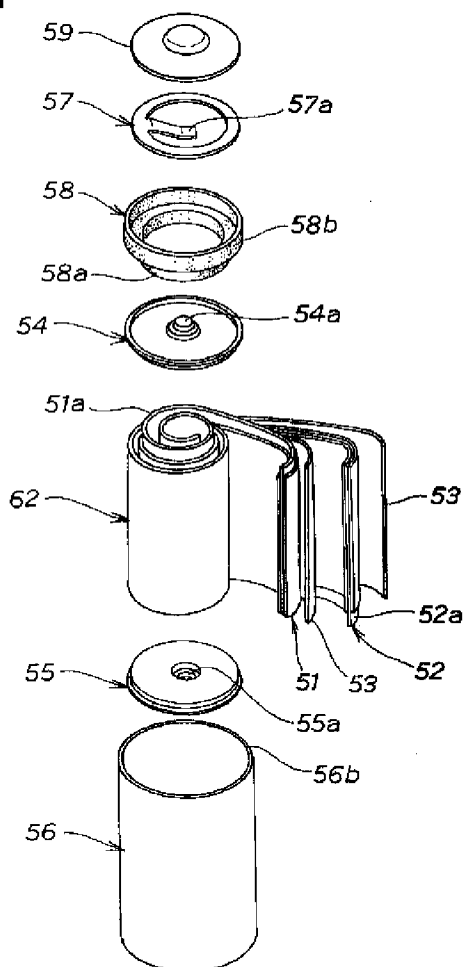




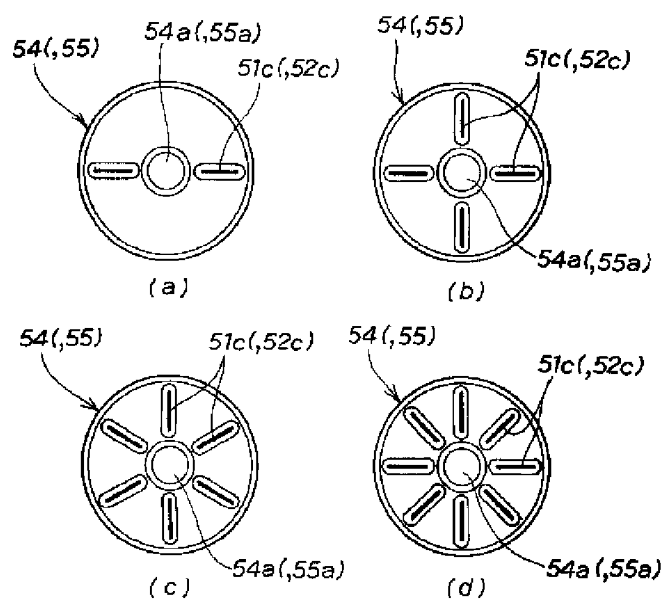


【図4】

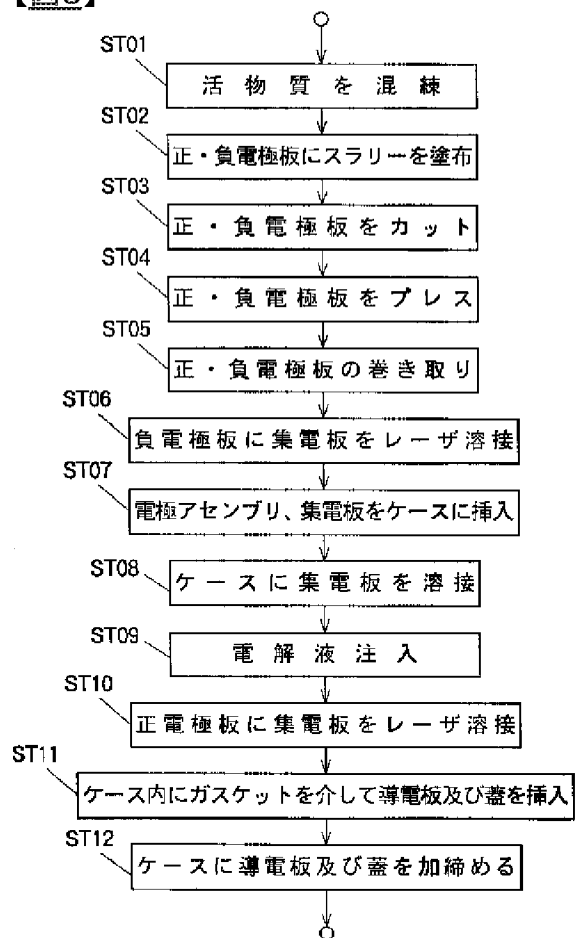
42



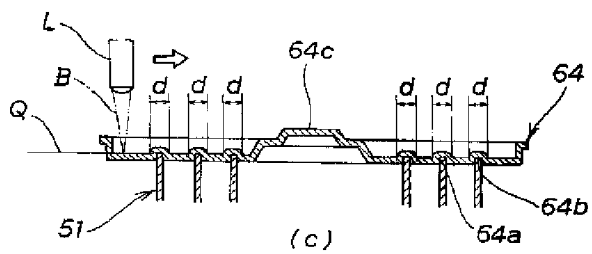
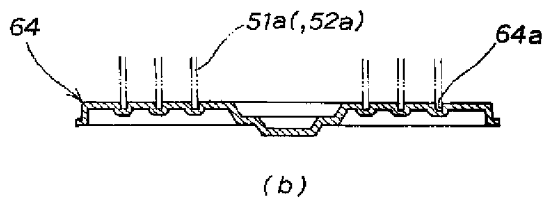
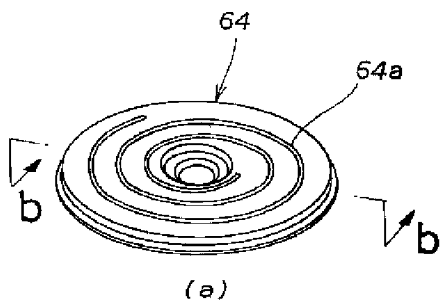
【図6】




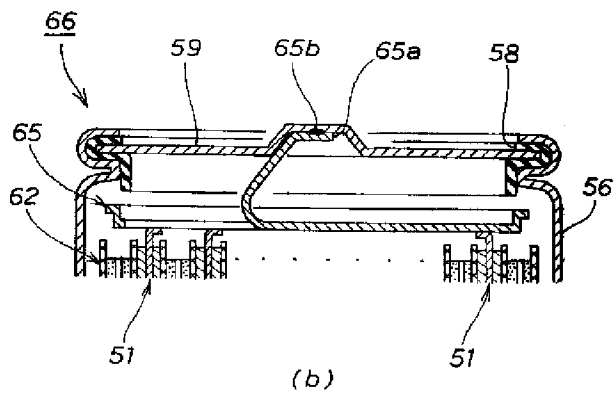
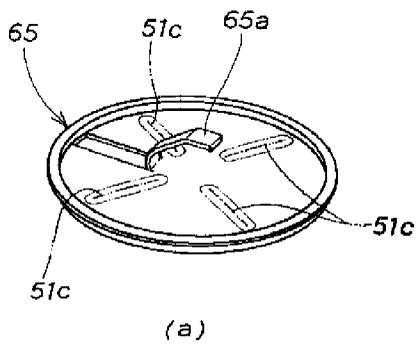
【図8】

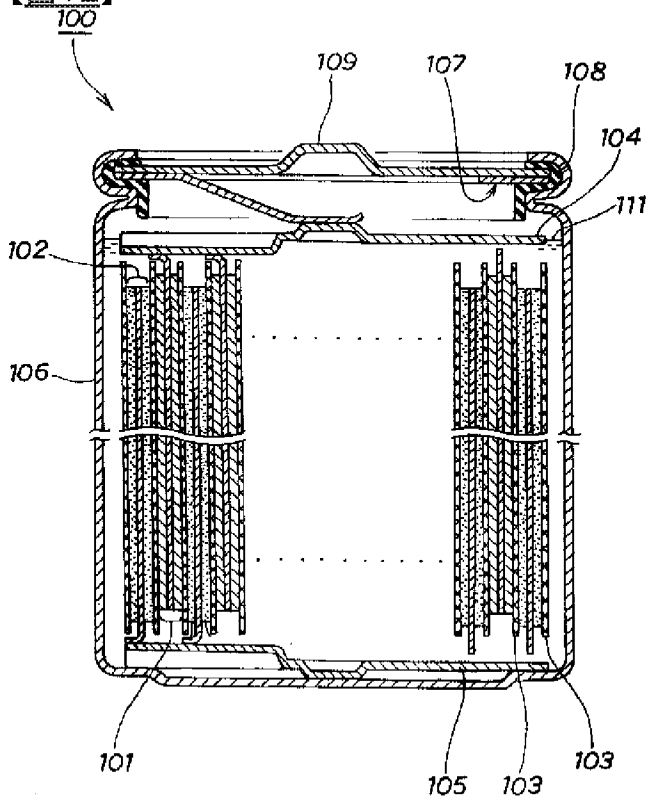


【図9】



【 10】





フロントページの続き

(51)Int.Cl.	国際記号	F I	ページ(参考)
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		0016	
		9408 9404 9405 9407 0005 0007	
		0019 0012	

## PATENT ABSTRACTS OF JAPAN

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(21)Application number : **10-225026**(71)Applicant : **HONDA MOTOR CO LTD**(22)Date of filing : **07.08.1998**

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**(54) ACCUMULATING ELEMENT**

(57)Abstract:

**PROBLEM TO BE SOLVED:** To improve reliability, while lowering the internal resistance by laser- welding a part of one edge of a positive and a negative electrodes housed in a case with the electrolyte in a condition in which it is not coated with an active material to a positive and a negative electrode terminals.

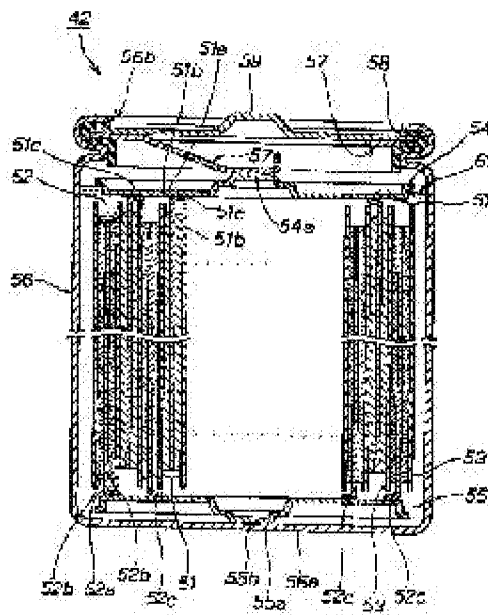
**SOLUTION:** A positive and a negative electrodes 51, 52 laminated through a separator 53 and housed in a conductive case 56 of a battery cell 42 have a positive and a negative electrode foils 51a, 52a, the active material 51b, 51b coated on both surfaces thereof, and an upper welding part 51c of the positive electrode 51 and a lower welding part 52c of the negative electrode 52. The welding parts 51c, 52, which are not coated with the active material 51b, 52b, are laser-welded to collector plates 54, 55 as positive and negative electrode terminals for securing

connection, and have conductivities higher than that of the parts coated with the active material 51b, 52b. The collector plates 54, 55 are preferably formed with a spiral groove or the like for insertion of the ends of the positive and the negative electrodes 51, 52, and an area of the bonding surface is increased, while the electrical resistance is lowered. The kinds of parts can be reduced by using each common collector plate 54, 55 in the positive electrode side and the negative electrode side.

**CLAIMS**

[Claim(s)]

[Claim 1]A storage element having provided an unpainted portion which does not apply an active material at one side of said right and negative electrode board in right and a negative electrode board stored with an electrolysis solution in a case, and carrying out



laser welding of this unpainted portion to it in a storage element of form which combines right and a negative pole terminal at right and a negative pole terminal.

[Claim 2]The storage element according to claim 1 forming a slot which inserts an end of said right and negative electrode board in said right and negative pole terminal.

[Claim 3]The storage element according to claim 1 or 2 having made said right and negative electrode board into rolled form in piles, and carrying out laser welding of said right and negative pole terminal to an end of this rolled form electrode plate.

## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to improvement of a storage element.

[0002]

[Description of the Prior Art]This invention persons provide previously the unpainted portion which does not paint an active material in one side of right and the negative electrode plate of a storage element by Japanese Patent Application No. No. 103050 [ nine to ] "storage element", The art which makes contact resistance small by assembling by applying right and a negative pole terminal to this unpainted portion, and raising productivity, and increasing the touch area of right and a negative electrode plate, and right and a negative pole terminal was proposed. The following figure explains this art.

[0003]Drawing 12 is a sectional view of the conventional storage element which applied right and a negative pole terminal to the unpainted portions of right and a negative electrode plate, and the storage element 100, The positive electrode board 101 and the negative electrode board 102 which applied the active material to both sides, respectively, The separator 103,103 formed between right [ these ] and the negative electrode board 101,102, The collecting electrode plate 104 which is the positive pole terminal which hit against the upper part of the positive electrode board 101, and the collecting electrode plate 105 which is the negative pole terminals which hit against the lower part of the negative electrode board 102, The existing case 106 of the conductivity which stores right [ these ] and the negative electrode board 101,102, the separator 103,103, and the collecting electrode plate 104,105, The plate conducting 107 which pushes right [ these ] and the negative electrode board 101,102, the separator 103,103, and the collecting electrode plate 104,105 against the pars basilaris ossis occipitalis of this case 106, the opening of the case 106 -- the plate conducting 107 -- the gasket 108 -- passing -- it consists of the closed lid 109 and the electrolysis solution 111 poured in into the case 106.

[0004]

[Problem(s) to be Solved by the Invention]the above-mentioned art -- the collecting electrode plate 105 -- the negative electrode board 102 -- \*\*\*\*\* and the positive electrode board 101 -- the collecting electrode plate 104 -- pressing \*\*\*\* -- electric power is taken out to the exterior by things. In order to call for the further miniaturization to a storage element, a weight saving, and large scale-ization by the demand of hybrid cars, electromobiles, battery-assisted bicycles, etc. and to take out electric power more efficiently in recent years, reduction of the internal resistance of a storage element is desired, for example. The above-mentioned vehicles also require the quality where each

storage element was stabilized, in order to use two or more storage elements. Then, the purpose of this invention reduces internal resistance more, and there is in providing the storage element which raised reliability.

[0005]

[Means for Solving the Problem]To achieve the above objects, in a storage element of form which combines right and a negative pole terminal with right and a negative electrode board stored with an electrolysis solution in a case, claim 1 of this invention provided an unpainted portion which does not apply an active material at one side of right and a negative electrode board, and carried out laser welding of this unpainted portion to right and a negative pole terminal. By laser welding, right and a negative pole terminal are certainly combined with right and a negative electrode board, respectively. Electrical resistance of a bond part of right and a negative electrode board, and right and a negative pole terminal becomes smaller.

[0006]Claim 2 formed a slot which inserts an end of right and a negative electrode board in right and a negative pole terminal. Area of a bond part of right and a negative electrode board, and right and a negative pole terminal becomes large, and electrical resistance of a bond part becomes smaller.

[0007]Claim 3 made right and a negative electrode board rolled form in piles, and carried out laser welding of right and the negative pole terminal to an end of this rolled form electrode plate. In order that right and a negative pole terminal may contact uniformly unpainted portions of right and a negative electrode board, combination by laser welding becomes more certain and electrical resistance of a bond part of right and a negative electrode board, and right and a negative pole terminal becomes smaller.

[0008]

[Embodiment of the Invention]An embodiment of the invention is described below based on an attached drawing. A drawing shall be seen to direction of numerals. This invention is a side view of a battery-assisted bicycle with a pedal, and drawing 1 is characterized by the battery-assisted bicycle 1 with a pedal comprising the following.

Frame 2.

The head tube 4 attached to the anterior part of this frame 2.

The upside handle stem 5 and the lower front fork 6 which were attached to this head tube 4 pivotable.

The handle bar 8 attached to the handle stem 5 by the handle lug 7, the front wheel 11 attached to the lower end of the front fork 6 pivotable, and the rear wheel 12 attached to the back end of the frame 2.

[0009]The down frame 14 to which the frame 2 extends in the back lower part of the head tube 4, It consists of the seat pillar which was started from the back end of this down frame 14 and which is not illustrated, the rear fork 15 extended from the back end of the above-mentioned down frame 14 to back, and the rear subfork 16 over which these seat pillars and the rear fork 15 back end were built.

[0010]The down frame 14 attaches the battery 17 removable, and forms the actuator 18 in a rear end part. The rear fork 15 attaches the rear wheel 12 and the chain sprocket 21 to the back end pivotable.

[0011]The actuator 18 consists of the electric motor 22, the gear drive 23 driven with this electric motor 22, and the pedals 24 and 24 (the back is omitted) attached to this gear



drive 23. If it connects with the battery 17, and the rotation and the torque control device which are not illustrated and people step on the pedals 24 and 24, in response to this, the electric motor 22 will rotate, will generate torque, and will assist treading strength.

[0012]The gear drive 23 tells driving force to the chain sprocket 21 via the chain 25, and rotates the rear wheel 12. Here, as for chain covers and 34, the pipe which 28 attached a front brake and 27 to the basket, attached it to the fender of the front wheel 11, and 31 attached to the seat pillar 26, and 32 are [ the fender of the rear wheel 12 and 36 ] stands a rear brake and 35 a sheet and 33.

[0013]Battery cell 42 as a storage element in which drawing 2 is a perspective view of the battery concerning this invention, and the battery 17 carried out the series connection of the plurality into the accommodating case 41 and this accommodating case 41 -- (-- shows plurality.) It is the same as that of the following. The connector 43 for connecting these battery cell 42 -- to the electric motor 22 (refer to drawing 1), It consists of the fuse 44 for preventing the over-current between these battery cell 42 -- and the electric motor 22, and the charging outlet 45 for charging battery cell 42 -- by a household power supply. 46 is a handle.

[0014]This invention is a sectional view (a 1st embodiment) showing a battery cell, and drawing 3 is characterized by the battery cell 42 comprising the following.

Positive electrode board 51.

Negative electrode board 52.

The separators 53 and 53 formed between right [ these ] and the negative electrode boards 51 and 52.

The collecting electrode plate 54 as a positive pole terminal which carried out laser welding to the upper part of the positive electrode board 51, The collecting electrode plate 55 as a negative pole terminal which carried out laser welding to the lower part of the negative electrode board 52, The existing case 56 of the conductivity which stores right [ these ] and the negative electrode boards 51 and 52, the separators 53 and 53, and the collecting electrode plates 54 and 55, The plate conducting 57 which is an elastic member for pushing right [ these ] and the negative electrode boards 51 and 52, the separators 53 and 53, and the collecting electrode plates 54 and 55 against the pars-basilaris-ossis-occipitalis 56a side of this case 56, the opening 56b of the upper part of the case 56 -- the plate conducting 57 -- the gasket 58 -- passing -- the closed lid 59 and the electrolysis solution 61 poured in into the case 56.

[0015]The positive electrode board 51 consists of the positive electrode foil 51a and the active materials 51b and 51b applied to both sides of this positive electrode foil 51a. 51c- is a weld zone of the positive electrode foil 51a and the collecting electrode plate 54.

The negative electrode board 52 consists of the negative electrode foil 52a and the active materials 52b and 52b applied to both sides of this negative electrode foil 52a. 52c-- is a weld zone of the negative electrode foil 52a and the collecting electrode plate 55.

[0016]The separator 53 insulates the positive electrode board 51 and the negative electrode board 52. Although the collecting electrode plates 54 and 55 were the same and being incorporated upside down, respectively, numerals were changed on account of explanation.

[0017]Thus, by using the common collecting electrode plates 54 and 55 by the anode and negative-electrode side, the kind of parts can be reduced and a manufacturing cost can be

held down. The plate conducting 57 has the pressing part 57a which generates thrust by making it bend at the time of with a group. Here, laser welding of the negative electrode board 52 may be carried out to the case 56, without using the collecting electrode plate 55 by the side of a negative electrode.

[0018]Drawing 4 is an exploded perspective view (a 1st embodiment) showing the battery cell concerning this invention, and in the case 56 The disc-like collecting electrode plate 55, The electrode assembly 62 as a rolled form electrode plate which wound the separator 53 around the outside of the positive electrode board 51 in piles on the outside of the negative electrode board 52 and the negative electrode board 52 at the outside of the separator 53 and the separator 53, Inserting the disc-like collecting electrode plate 54 in this order, inserting in the opening 56b of the upper bed of the case 56 the narrow diameter portion 58a established in the gasket 58, and inserting the plate conducting 57 and the lid 59 in the inner surface of the major diameter 58b provided in the gasket 58 is shown.

[0019]After the battery cell 42 inserts the plate conducting 57 and the lid 59 in the opening 56b of the case 56, as shown in drawing 3, it extracts the case 56 to the method of the inside of a path, and seals the upper part of the case 56. The collecting electrode plates 54 and 55 form the heights 54a and 55a in the center.

[0020]The heights 54a are the portions in contact with the pressing part 57a of the plate conducting 57. The heights 55a are portions which carry out laser welding to the pars basilaris ossis occipitalis 56a (refer to drawing 3) of the case 56. (55b shown in drawing 3 is a weld zone.) In addition, combination with the heights 55a and the pars basilaris ossis occipitalis 56a may be performed with other welding processes. The case 56 carries out the insulation process of the outside surface electrically except for the pars basilaris ossis occipitalis 56a (refer to drawing 3).

[0021]Drawing 5 is a figure explaining the electrode plate concerning this invention, and except for one side of the positive electrode foil 51a, the positive electrode board 51 applies the active material 51b, and secures the unpainted portions 51d and 51d (51 d on the back side is un-illustrating) to width fixed in one side of the upper parts of the positive electrode board 51.

[0022]Except for one side of the negative electrode foil 52a, the negative electrode board 52 applies the active material 52b, and secures the unpainted portions 52d and 52d (52 d on the back side is un-illustrating) to width fixed in one side of lower parts of the negative electrode board 52. These unpainted portions 51d, 51d, 52d, and 52d have good conductivity compared with the portion which applied the active materials 51b and 52b.

[0023]Roll these positive electrode boards 51 and the negative electrode board 52 so that the active material 51b and 52b portion may lap via the separator 53, and the unpainted portions 51d and 52d are made to project from the end of the rolled form electrode assembly 62, and it stores in the case 56 (refer to drawing 4).

[0024]As described above, right and the negative electrode boards 51 and 52 by having used the rolled form electrode assembly 62 in piles. Since the collecting electrode plates 54 and 55 (refer to drawing 3) are uniformly contacted at the end of the electrode assembly 62 and laser welding is possible, combination by laser welding can be made more reliable and electrical resistance of the bond part of right and the negative electrode boards 51 and 52, and the collecting electrode plates 54 and 55 can be made smaller. Therefore, internal resistance of the battery cell 42 (refer to drawing 3) can be made

smaller.

[0025]Drawing 6 (a) - (d) is a top view of the collecting electrode plate concerning this invention, and shows the gestalt of laser welding of a collecting electrode plate, and right and a negative electrode board in two or more examples. Except for the heights 54a (or heights 55a of the collecting electrode plate 55) of the collecting electrode plate 54, laser welding of the (a) is carried out to straight line shape. Except for the heights 54a (or heights 55a), laser welding of the (b) is carried out to cross shape.

[0026]Except for the heights 54a (or heights 55a), laser welding of the (c) is carried out to 60-degree regular intervals. Except for the heights 54a (or heights 55a), laser welding of the (d) is carried out to 45-degree regular intervals.

[0027]Drawing 7 is a sectional view explaining the method of laser welding of right and negative electrode board, and collecting electrode plate concerning this invention. In order to carry out laser welding of the collecting electrode plate 54 to the positive electrode board 51, First, the collecting electrode plate 54 is pushed against the end of the electrode assembly 62, and the focus of the laser beam B of laser-beam-welding-equipment L is doubled with height position P of the contact portion of the positive electrode board 51 and the collecting electrode plate 54, and it welds, moving laser-beam-welding-equipment L to the inner circumference side from the periphery side of the electrode assembly 62.

[0028]If laser-beam-welding-equipment L comes to the heights 54a section of the collecting electrode plate 54, the exposure of the end laser beam B will be stopped, if the heights 54a section is passed, the exposure of the laser beam B will be begun again, and it welds, moving laser-beam-welding-equipment L to the periphery side from the inner circumference side of the electrode assembly 62. When carrying out laser welding of the collecting electrode plate 55 to the negative electrode board 52, it carries out similarly.

[0029]Drawing 8 is a flow chart (a 1st embodiment) of the manufacturing process of the electrode assembly concerning this invention. STxx shows a step number. (Numerals are drawing 3 and referring to drawing 5)

ST01 .... Right and the negative electrode board 51, and the active materials 51b and 52b for 52 are kneaded.

ST02 .... The active materials 51b and 52b kneaded by ST01 are made into slurry form, and it applies to right and the negative electrode foil 51a and 52a. However, the above-mentioned unpainted portions 51d and 52d are formed.

[0030]ST03 .... Right and the negative electrode boards 51 and 52 are cut into a regular size.

ST04 .... Right and the negative electrode boards 51 and 52 are pressed, and thickness including the active materials 51b and 52b is fixed.

ST05 .... Right and the negative electrode boards 51 and 52 are rolled round, and the electrode assembly 62 is produced.

ST06 .... Laser welding of the collecting electrode plate 55 is carried out to the negative electrode board 52.

ST07 .... The electrode assembly 62 and the collecting electrode plate 55 are inserted in the case 56.

[0031]ST08 .... Laser welding of the collecting electrode plate 55 is carried out to the case 56.

ST09 .... The electrolysis solution 61 is poured in into the case 56.

ST10 .... Laser welding of the collecting electrode plate 54 is carried out to the positive electrode board 51.

ST11 .... The plate conducting 57 and the lid 59 are inserted via the gasket 58 into the case 56.

ST12 .... It is \*\*\*\*\* about the plate conducting 57 and the lid 59 to the case 56.

[0032]Drawing 9 (a) - (c) is an explanatory view (a 2nd embodiment) explaining the modification of a collecting electrode plate, and is a sectional view where (a) explains a perspective view, (b) explains the b-b line sectional view of (a), and (c) explains the method of laser welding. Explanation is omitted about the 1st embodiment and identical configuration. In (a), the collecting electrode plate 64 forms the spiral slot 64a which inserts the unpainted portions 51d and 52d (refer to drawing 5) which are the ends of right and the negative electrode boards 51 and 52 (refer to drawing 5). In (b), the spiral slot 64a is formed in the collecting electrode plate 64 by cutting, press working of sheet metal, etc., and the width can insert right and the negative electrode foil 51a and 52a of right and the negative electrode boards 51 and 52 (refer to drawing 5).

[0033]In (c), in order to carry out laser welding of the collecting electrode plate 64 to the positive electrode board 51, First, the end of the positive electrode board 51 is inserted to the groove bottom 64b of the spiral slot 64a of the collecting electrode plate 64, The focus of the laser beam B of laser-beam-welding-equipment L is doubled with the contact portion 64b (this height position is set to Q.) of the positive electrode board 51 and the collecting electrode plate 64, i.e., the groove bottom of the spiral slot 64a, and it welds, moving laser-beam-welding-equipment L to the inner circumference side from the periphery side of the collecting electrode plate 64.

[0034]If laser-beam-welding-equipment L comes to the heights 64c section of the collecting electrode plate 64, the exposure of the end laser beam B will be stopped, if the heights 64c section is passed, the exposure of the laser beam B will be begun again, and it welds, moving laser-beam-welding-equipment L to the periphery side from the inner circumference side of the collecting electrode plate 64. When carrying out laser welding of the collecting electrode plate 64 to the negative electrode board 52, it carries out similarly. Here, laser welding only of the about 51 positive electrode board length d may be intermittently carried out for laser-beam-welding-equipment L during movement, for example. Thereby, influence of the heat generated by laser welding can be lessened.

[0035]As described above, by having formed the spiral slot 64a which inserts the end of right and the negative electrode boards 51 and 52 (refer to drawing 5) in the collecting electrode plate 64, area of the bond part of right and the negative electrode boards 51 and 52, and the collecting electrode plate 64 can be enlarged, and electrical resistance of a bond part can be made smaller.

[0036]Drawing 10 (a) and (b) is an explanatory view (a 3rd embodiment) explaining another modification of the collecting electrode plate concerning this invention, and is a sectional view showing the state where (a) incorporated the perspective view and (b) built the collecting electrode plate into the battery cell. Explanation is omitted about the 1st embodiment and identical configuration. In (a), the collecting electrode plate 65 forms the rising part 65a for combining with the lid 59 (refer to drawing 4). In (b), the battery cell 66 carries out laser welding of the collecting electrode plate 65 to the positive electrode board 51 of the electrode assembly 62, and carries out laser welding of the lid 59 to the collecting electrode plate 65. (51c-- (refer to (a))) and 65b are weld zones.

Combination with the collecting electrode plate 65 and the lid 59 may be performed with other welding processes.

[0037]In order that the case 56, the collecting electrode plate 55 (refer to drawing 3) and the collecting electrode plate 55, the negative electrode board 52 (refer to drawing 3) and the positive electrode board 51, the collecting electrode plate 65 and the collecting electrode plate 65, and the lid 59 may join together by welding by this, respectively, Electrical resistance of a bond part can be made smaller and the internal resistance of the battery cell 66 can be reduced more.

[0038]Drawing 11 is a sectional view (a 4th embodiment) showing the battery cell concerning this invention, and omits explanation about the 1st embodiment and identical configuration. The collecting electrode plate 71 as a positive pole terminal which carried out laser welding of the battery cell 70 to the upper part of the positive electrode board 51, It consists of the case 73 with the electric insulation which stores the collecting electrode plate 72, and right and the negative electrode boards 51 and 52, the separators 53 and 53 and the collecting electrode plates 71 and 72 as a negative pole terminal which carried out laser welding to the lower part of the negative electrode board 52.

[0039]The electrode assembly 62 impregnates with the electrolysis solution 61 (not shown). The collecting electrode plate 71 consists of the disc-like part 71a and the terminal area 71b attached in the center of this disc-like part 71a. The collecting electrode plates 72 are the collecting electrode plate 71 and identical shape, and consist of the disc-like part 72a and the terminal area 72b attached in the center of this disc-like part 72a. The case 73 consists of the case body 73a and the lid member 73b which plugs up the opening of this case body 73a. 73c and 73c are insertion holes.

[0040]Carry out laser welding of the collecting electrode plates 71 and 72 for the battery cell 70 to \*\*\*\*\* at the electrode assembly 62, and the terminal area 72b of the collecting electrode plate 72 is pressed fit in the insertion hole 73c of the case body 73a, The electrode assembly 62 and the collecting electrode plates 71 and 72 are stored to the case body 73a, and while pressing fit the terminal area 71b of the collecting electrode plate 71 in the insertion hole 73c of the lid member 73b, the lid member 73b is welded 73a.

[0041]In an embodiment of the invention, although laser welding of the collecting electrode plates 54, 55 (refer to drawing 3), 64 (refer to drawing 9), 65 (refer to drawing 10), 71, and 72 was carried out to right and the negative electrode boards 51 and 52, it may not restrict to this and resistance welding and electron beam welding may be sufficient. The combination with right and the negative electrode boards 51 and 52, and the collecting electrode plates 54, 55, 64, 65, 71, and 72 in the battery cells 42 (refer to drawing 3), 66 (refer to drawing 10), and 70 of this invention, It can be adapted for rechargeable batteries and electric double layer capacitors, such as a lithium ion battery, a lead battery, a nickel-cadmium battery, and a nickel hydride battery, and an aluminum foil form electrolytic condenser.

[0042]

[Effect of the Invention]This invention demonstrates the following effect by the above-mentioned composition. Since the storage element of claim 1 carried out laser welding of right and the negative pole terminal to right and a negative electrode board, respectively, by laser welding, it can combine right and a negative pole terminal with right and a negative electrode board certainly, and can raise reliability. Electrical resistance of the bond part of right and a negative electrode board, and right and a negative pole terminal

can be made smaller, and the internal resistance of a storage element can be reduced more.

[0043]Since the storage element of claim 2 formed the slot which inserts the end of right and a negative electrode board in right and a negative pole terminal, it can enlarge area of the bond part of right and a negative electrode board, and right and a negative pole terminal, can make electrical resistance of a bond part smaller, and can reduce the internal resistance of a storage element more.

[0044]Since the storage element of claim 3 used right and a negative electrode board as the rolled form electrode plate in piles, it contacts right and a negative pole terminal at the end of a rolled form electrode plate uniformly and laser welding of it can be carried out, combination by laser welding can be made more reliable and the stable quality can be acquired. Electrical resistance of the bond part of right and a negative electrode board, and right and a negative pole terminal can be made smaller, and the internal resistance of a storage element can be reduced more.

## TECHNICAL FIELD

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[Field of the Invention]This invention relates to improvement of a storage element.

## PRIOR ART

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[Description of the Prior Art]This invention persons provide previously the unpainted portion which does not paint an active material in one side of right and the negative electrode plate of a storage element by Japanese Patent Application No. No. 103050 [ nine to ] "storage element", The art which makes contact resistance small by assembling by applying right and a negative pole terminal to this unpainted portion, and raising productivity, and increasing the touch area of right and a negative electrode plate, and right and a negative pole terminal was proposed. The following figure explains this art.

[0003]Drawing 12 is a sectional view of the conventional storage element which applied right and a negative pole terminal to the unpainted portions of right and a negative electrode plate, and the storage element 100, The positive electrode board 101 and the negative electrode board 102 which applied the active material to both sides, respectively, The separator 103,103 formed between right [ these ] and the negative electrode board 101,102, The collecting electrode plate 104 which is the positive pole terminal which hit against the upper part of the positive electrode board 101, and the collecting electrode plate 105 which is the negative pole terminals which hit against the lower part of the negative electrode board 102, The existing case 106 of the conductivity which stores right [ these ] and the negative electrode board 101,102, the separator 103,103, and the collecting electrode plate 104,105, The plate conducting 107 which pushes right [ these ] and the negative electrode board 101,102, the separator 103,103, and the collecting electrode plate 104,105 against the pars basilaris ossis occipitalis of this case 106, the opening of the case 106 -- the plate conducting 107 -- the gasket 108 -- passing -- it consists of the closed lid 109 and the electrolysis solution 111 poured in into the case 106.

## EFFECT OF THE INVENTION

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[Effect of the Invention] This invention demonstrates the following effect by the above-mentioned composition. Since the storage element of claim 1 carried out laser welding of right and the negative pole terminal to right and a negative electrode board, respectively, by laser welding, it can combine right and a negative pole terminal with right and a negative electrode board certainly, and can raise reliability. Electrical resistance of the bond part of right and a negative electrode board, and right and a negative pole terminal can be made smaller, and the internal resistance of a storage element can be reduced more.

[0043] Since the storage element of claim 2 formed the slot which inserts the end of right and a negative electrode board in right and a negative pole terminal, it can enlarge area of the bond part of right and a negative electrode board, and right and a negative pole terminal, can make electrical resistance of a bond part smaller, and can reduce the internal resistance of a storage element more.

[0044] Since the storage element of claim 3 used right and a negative electrode board as the rolled form electrode plate in piles, it contacts right and a negative pole terminal at the end of a rolled form electrode plate uniformly and laser welding of it can be carried out, combination by laser welding can be made more reliable and the stable quality can be acquired. Electrical resistance of the bond part of right and a negative electrode board, and right and a negative pole terminal can be made smaller, and the internal resistance of a storage element can be reduced more.

## TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] the above-mentioned art -- the collecting electrode plate 105 -- the negative electrode board 102 -- \*\*\*\*\* and the positive electrode board 101 -- the collecting electrode plate 104 -- pressing \*\*\*\*\* -- electric power is taken out to the exterior by things. In order to call for the further miniaturization to a storage element, a weight saving, and large scale-ization by the demand of hybrid cars, electromobiles, battery-assisted bicycles, etc. and to take out electric power more efficiently in recent years, reduction of the internal resistance of a storage element is desired, for example. The above-mentioned vehicles also require the quality where each storage element was stabilized, in order to use two or more storage elements. Then, the purpose of this invention reduces internal resistance more, and there is in providing the storage element which raised reliability.

## MEANS

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[Means for Solving the Problem] To achieve the above objects, in a storage element of form which combines right and a negative pole terminal with right and a negative electrode board stored with an electrolysis solution in a case, claim 1 of this invention provided an unpainted portion which does not apply an active material at one side of right and a negative electrode board, and carried out laser welding of this unpainted portion to right and a negative pole terminal. By laser welding, right and a negative pole terminal are certainly combined with right and a negative electrode board, respectively. Electrical resistance of a bond part of right and a negative electrode board, and right and a negative pole terminal becomes smaller.

[0006]Claim 2 formed a slot which inserts an end of right and a negative electrode board in right and a negative pole terminal. Area of a bond part of right and a negative electrode board, and right and a negative pole terminal becomes large, and electrical resistance of a bond part becomes smaller.

[0007]Claim 3 made right and a negative electrode board rolled form in piles, and carried out laser welding of right and the negative pole terminal to an end of this rolled form electrode plate. In order that right and a negative pole terminal may contact uniformly unpainted portions of right and a negative electrode board, combination by laser welding becomes more certain and electrical resistance of a bond part of right and a negative electrode board, and right and a negative pole terminal becomes smaller.

[0008]

[Embodiment of the Invention]An embodiment of the invention is described below based on an attached drawing. A drawing shall be seen to direction of numerals. This invention is a side view of a battery-assisted bicycle with a pedal, and drawing 1 is characterized by the battery-assisted bicycle 1 with a pedal comprising the following.

Frame 2.

The head tube 4 attached to the anterior part of this frame 2.

The upside handle stem 5 and the lower front fork 6 which were attached to this head tube 4 pivotable.

The handle bar 8 attached to the handle stem 5 by the handle lug 7, the front wheel 11 attached to the lower end of the front fork 6 pivotable, and the rear wheel 12 attached to the back end of the frame 2.

[0009]The down frame 14 to which the frame 2 extends in the back lower part of the head tube 4, It consists of the seat pillar which was started from the back end of this down frame 14 and which is not illustrated, the rear fork 15 extended from the back end of the above-mentioned down frame 14 to back, and the rear subfork 16 over which these seat pillars and the rear fork 15 back end were built.

[0010]The down frame 14 attaches the battery 17 removable, and forms the actuator 18 in a rear end part. The rear fork 15 attaches the rear wheel 12 and the chain sprocket 21 to the back end pivotable.

[0011]The actuator 18 consists of the electric motor 22, the gear drive 23 driven with this electric motor 22, and the pedals 24 and 24 (the back is omitted) attached to this gear drive 23. If it connects with the battery 17, and the rotation and the torque control device which are not illustrated and people step on the pedals 24 and 24, in response to this, the electric motor 22 will rotate, will generate torque, and will assist treading strength.

[0012]The gear drive 23 tells driving force to the chain sprocket 21 via the chain 25, and rotates the rear wheel 12. Here, as for chain covers and 34, the pipe which 28 attached a front brake and 27 to the basket, attached it to the fender of the front wheel 11, and 31 attached to the seat pillar 26, and 32 are [ the fender of the rear wheel 12 and 36 ] stands a rear brake and 35 a sheet and 33.

[0013]Battery cell 42 as a storage element in which drawing 2 is a perspective view of the battery concerning this invention, and the battery 17 carried out the series connection of the plurality into the accommodating case 41 and this accommodating case 41 -- (-- shows plurality.) It is the same as that of the following. The connector 43 for connecting these battery cell 42 -- to the electric motor 22 (refer to drawing 1), It consists of the fuse



44 for preventing the over-current between these battery cell 42 -- and the electric motor 22, and the charging outlet 45 for charging battery cell 42 -- by a household power supply. 46 is a handle.

[0014]This invention is a sectional view (a 1st embodiment) showing a battery cell, and drawing 3 is characterized by the battery cell 42 comprising the following.

Positive electrode board 51.

Negative electrode board 52.

The separators 53 and 53 formed between right [ these ] and the negative electrode boards 51 and 52.

The collecting electrode plate 54 as a positive pole terminal which carried out laser welding to the upper part of the positive electrode board 51, The collecting electrode plate 55 as a negative pole terminal which carried out laser welding to the lower part of the negative electrode board 52, The existing case 56 of the conductivity which stores right [ these ] and the negative electrode boards 51 and 52, the separators 53 and 53, and the collecting electrode plates 54 and 55, The plate conducting 57 which is an elastic member for pushing right [ these ] and the negative electrode boards 51 and 52, the separators 53 and 53, and the collecting electrode plates 54 and 55 against the pars-basilaris-ossis-occipitalis 56a side of this case 56, the opening 56b of the upper part of the case 56 -- the plate conducting 57 -- the gasket 58 -- passing -- the closed lid 59 and the electrolysis solution 61 poured in into the case 56.

[0015]The positive electrode board 51 consists of the positive electrode foil 51a and the active materials 51b and 51b applied to both sides of this positive electrode foil 51a. 51c- is a weld zone of the positive electrode foil 51a and the collecting electrode plate 54. The negative electrode board 52 consists of the negative electrode foil 52a and the active materials 52b and 52b applied to both sides of this negative electrode foil 52a. 52c-- is a weld zone of the negative electrode foil 52a and the collecting electrode plate 55.

[0016]The separator 53 insulates the positive electrode board 51 and the negative electrode board 52. Although the collecting electrode plates 54 and 55 were the same and being incorporated upside down, respectively, numerals were changed on account of explanation.

[0017]Thus, by using the common collecting electrode plates 54 and 55 by the anode and negative-electrode side, the kind of parts can be reduced and a manufacturing cost can be held down. The plate conducting 57 has the pressing part 57a which generates thrust by making it bend at the time of with a group. Here, laser welding of the negative electrode board 52 may be carried out to the case 56, without using the collecting electrode plate 55 by the side of a negative electrode.

[0018]Drawing 4 is an exploded perspective view (a 1st embodiment) showing the battery cell concerning this invention, and in the case 56 The disc-like collecting electrode plate 55, The electrode assembly 62 as a rolled form electrode plate which wound the separator 53 around the outside of the positive electrode board 51 in piles on the outside of the negative electrode board 52 and the negative electrode board 52 at the outside of the separator 53 and the separator 53, Inserting the disc-like collecting electrode plate 54 in this order, inserting in the opening 56b of the upper bed of the case 56 the narrow diameter portion 58a established in the gasket 58, and inserting the plate conducting 57 and the lid 59 in the inner surface of the major diameter 58b provided in

the gasket 58 is shown.

[0019]After the battery cell 42 inserts the plate conducting 57 and the lid 59 in the opening 56b of the case 56, as shown in drawing 3, it extracts the case 56 to the method of the inside of a path, and seals the upper part of the case 56. The collecting electrode plates 54 and 55 form the heights 54a and 55a in the center.

[0020]The heights 54a are the portions in contact with the pressing part 57a of the plate conducting 57. The heights 55a are portions which carry out laser welding to the pars basilaris ossis occipitalis 56a (refer to drawing 3) of the case 56. (55b shown in drawing 3 is a weld zone.) In addition, combination with the heights 55a and the pars basilaris ossis occipitalis 56a may be performed with other welding processes. The case 56 carries out the insulation process of the outside surface electrically except for the pars basilaris ossis occipitalis 56a (refer to drawing 3).

[0021]Drawing 5 is a figure explaining the electrode plate concerning this invention, and except for one side of the positive electrode foil 51a, the positive electrode board 51 applies the active material 51b, and secures the unpainted portions 51d and 51d (51 d on the back side is un-illustrating) to width fixed in one side of the upper parts of the positive electrode board 51.

[0022]Except for one side of the negative electrode foil 52a, the negative electrode board 52 applies the active material 52b, and secures the unpainted portions 52d and 52d (52 d on the back side is un-illustrating) to width fixed in one side of lower parts of the negative electrode board 52. These unpainted portions 51d, 51d, 52d, and 52d have good conductivity compared with the portion which applied the active materials 51b and 52b.

[0023]Roll these positive electrode boards 51 and the negative electrode board 52 so that the active material 51b and 52b portion may lap via the separator 53, and the unpainted portions 51d and 52d are made to project from the end of the rolled form electrode assembly 62, and it stores in the case 56 (refer to drawing 4).

[0024]As described above, right and the negative electrode boards 51 and 52 by having used the rolled form electrode assembly 62 in piles. Since the collecting electrode plates 54 and 55 (refer to drawing 3) are uniformly contacted at the end of the electrode assembly 62 and laser welding is possible, combination by laser welding can be made more reliable and electrical resistance of the bond part of right and the negative electrode boards 51 and 52, and the collecting electrode plates 54 and 55 can be made smaller. Therefore, internal resistance of the battery cell 42 (refer to drawing 3) can be made smaller.

[0025]Drawing 6 (a) - (d) is a top view of the collecting electrode plate concerning this invention, and shows the gestalt of laser welding of a collecting electrode plate, and right and a negative electrode board in two or more examples. Except for the heights 54a (or heights 55a of the collecting electrode plate 55) of the collecting electrode plate 54, laser welding of the (a) is carried out to straight line shape. Except for the heights 54a (or heights 55a), laser welding of the (b) is carried out to cross shape.

[0026]Except for the heights 54a (or heights 55a), laser welding of the (c) is carried out to 60-degree regular intervals. Except for the heights 54a (or heights 55a), laser welding of the (d) is carried out to 45-degree regular intervals.

[0027]Drawing 7 is a sectional view explaining the method of laser welding of right and negative electrode board, and collecting electrode plate concerning this invention. In order to carry out laser welding of the collecting electrode plate 54 to the positive

electrode board 51, First, the collecting electrode plate 54 is pushed against the end of the electrode assembly 62, and the focus of the laser beam B of laser-beam-welding-equipment L is doubled with height position P of the contact portion of the positive electrode board 51 and the collecting electrode plate 54, and it welds, moving laser-beam-welding-equipment L to the inner circumference side from the periphery side of the electrode assembly 62.

[0028]If laser-beam-welding-equipment L comes to the heights 54a section of the collecting electrode plate 54, the exposure of the end laser beam B will be stopped, if the heights 54a section is passed, the exposure of the laser beam B will be begun again, and it welds, moving laser-beam-welding-equipment L to the periphery side from the inner circumference side of the electrode assembly 62. When carrying out laser welding of the collecting electrode plate 55 to the negative electrode board 52, it carries out similarly.

[0029]Drawing 8 is a flow chart (a 1st embodiment) of the manufacturing process of the electrode assembly concerning this invention. STxx shows a step number. (Numerals are drawing 3 and referring to drawing 5)

ST01 .... Right and the negative electrode board 51, and the active materials 51b and 52b for 52 are kneaded.

ST02 .... The active materials 51b and 52b kneaded by ST01 are made into slurry form, and it applies to right and the negative electrode foil 51a and 52a. However, the above-mentioned unpainted portions 51d and 52d are formed.

[0030]ST03 .... Right and the negative electrode boards 51 and 52 are cut into a regular size.

ST04 .... Right and the negative electrode boards 51 and 52 are pressed, and thickness including the active materials 51b and 52b is fixed.

ST05 .... Right and the negative electrode boards 51 and 52 are rolled round, and the electrode assembly 62 is produced.

ST06 .... Laser welding of the collecting electrode plate 55 is carried out to the negative electrode board 52.

ST07 .... The electrode assembly 62 and the collecting electrode plate 55 are inserted in the case 56.

[0031]ST08 .... Laser welding of the collecting electrode plate 55 is carried out to the case 56.

ST09 .... The electrolysis solution 61 is poured in into the case 56.

ST10 .... Laser welding of the collecting electrode plate 54 is carried out to the positive electrode board 51.

ST11 .... The plate conducting 57 and the lid 59 are inserted via the gasket 58 into the case 56.

ST12 .... It is \*\*\*\*\* about the plate conducting 57 and the lid 59 to the case 56.

[0032]Drawing 9 (a) - (c) is an explanatory view (a 2nd embodiment) explaining the modification of a collecting electrode plate, and is a sectional view where (a) explains a perspective view, (b) explains the b-b line sectional view of (a), and (c) explains the method of laser welding. Explanation is omitted about the 1st embodiment and identical configuration. In (a), the collecting electrode plate 64 forms the spiral slot 64a which inserts the unpainted portions 51d and 52d (refer to drawing 5) which are the ends of right and the negative electrode boards 51 and 52 (refer to drawing 5). In (b), the spiral slot 64a is formed in the collecting electrode plate 64 by cutting, press working of sheet

metal, etc., and the width can insert right and the negative electrode foil 51a and 52a of right and the negative electrode boards 51 and 52 (refer to drawing 5).

[0033]In (c), in order to carry out laser welding of the collecting electrode plate 64 to the positive electrode board 51, First, the end of the positive electrode board 51 is inserted to the groove bottom 64b of the spiral slot 64a of the collecting electrode plate 64, The focus of the laser beam B of laser-beam-welding-equipment L is doubled with the contact portion 64b (this height position is set to Q.) of the positive electrode board 51 and the collecting electrode plate 64, i.e., the groove bottom of the spiral slot 64a, and it welds, moving laser-beam-welding-equipment L to the inner circumference side from the periphery side of the collecting electrode plate 64.

[0034]If laser-beam-welding-equipment L comes to the heights 64c section of the collecting electrode plate 64, the exposure of the end laser beam B will be stopped, if the heights 64c section is passed, the exposure of the laser beam B will be begun again, and it welds, moving laser-beam-welding-equipment L to the periphery side from the inner circumference side of the collecting electrode plate 64. When carrying out laser welding of the collecting electrode plate 64 to the negative electrode board 52, it carries out similarly. Here, laser welding only of the about 51 positive electrode board length d may be intermittently carried out for laser-beam-welding-equipment L during movement, for example. Thereby, influence of the heat generated by laser welding can be lessened.

[0035]As described above, by having formed the spiral slot 64a which inserts the end of right and the negative electrode boards 51 and 52 (refer to drawing 5) in the collecting electrode plate 64, area of the bond part of right and the negative electrode boards 51 and 52, and the collecting electrode plate 64 can be enlarged, and electrical resistance of a bond part can be made smaller.

[0036]Drawing 10 (a) and (b) is an explanatory view (a 3rd embodiment) explaining another modification of the collecting electrode plate concerning this invention, and is a sectional view showing the state where (a) incorporated the perspective view and (b) built the collecting electrode plate into the battery cell. Explanation is omitted about the 1st embodiment and identical configuration. In (a), the collecting electrode plate 65 forms the rising part 65a for combining with the lid 59 (refer to drawing 4). In (b), the battery cell 66 carries out laser welding of the collecting electrode plate 65 to the positive electrode board 51 of the electrode assembly 62, and carries out laser welding of the lid 59 to the collecting electrode plate 65. (51c-- (refer to (a))) and 65b are weld zones. Combination with the collecting electrode plate 65 and the lid 59 may be performed with other welding processes.

[0037]In order that the case 56, the collecting electrode plate 55 (refer to drawing 3) and the collecting electrode plate 55, the negative electrode board 52 (refer to drawing 3) and the positive electrode board 51, the collecting electrode plate 65 and the collecting electrode plate 65, and the lid 59 may join together by welding by this, respectively, Electrical resistance of a bond part can be made smaller and the internal resistance of the battery cell 66 can be reduced more.

[0038]Drawing 11 is a sectional view (a 4th embodiment) showing the battery cell concerning this invention, and omits explanation about the 1st embodiment and identical configuration. The collecting electrode plate 71 as a positive pole terminal which carried out laser welding of the battery cell 70 to the upper part of the positive electrode board 51, It consists of the case 73 with the electric insulation which stores the collecting

electrode plate 72, and right and the negative electrode boards 51 and 52, the separators 53 and 53 and the collecting electrode plates 71 and 72 as a negative pole terminal which carried out laser welding to the lower part of the negative electrode board 52.

[0039]The electrode assembly 62 impregnates with the electrolysis solution 61 (not shown). The collecting electrode plate 71 consists of the disc-like part 71a and the terminal area 71b attached in the center of this disc-like part 71a. The collecting electrode plates 72 are the collecting electrode plate 71 and identical shape, and consist of the disc-like part 72a and the terminal area 72b attached in the center of this disc-like part 72a. The case 73 consists of the case body 73a and the lid member 73b which plugs up the opening of this case body 73a. 73c and 73c are insertion holes.

[0040]Carry out laser welding of the collecting electrode plates 71 and 72 for the battery cell 70 to \*\*\*\*\* at the electrode assembly 62, and the terminal area 72b of the collecting electrode plate 72 is pressed fit in the insertion hole 73c of the case body 73a, The electrode assembly 62 and the collecting electrode plates 71 and 72 are stored to the case body 73a, and while pressing fit the terminal area 71b of the collecting electrode plate 71 in the insertion hole 73c of the lid member 73b, the lid member 73b is welded 73a.

[0041]In an embodiment of the invention, although laser welding of the collecting electrode plates 54, 55 (refer to drawing 3), 64 (refer to drawing 9), 65 (refer to drawing 10), 71, and 72 was carried out to right and the negative electrode boards 51 and 52, it may not restrict to this and resistance welding and electron beam welding may be sufficient. The combination with right and the negative electrode boards 51 and 52, and the collecting electrode plates 54, 55, 64, 65, 71, and 72 in the battery cells 42 (refer to drawing 3), 66 (refer to drawing 10), and 70 of this invention, It can be adapted for rechargeable batteries and electric double layer capacitors, such as a lithium ion battery, a lead battery, a nickel-cadmium battery, and a nickel hydride battery, and an aluminum foil form electrolytic condenser.

## **DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1]The side view of the battery-assisted bicycle with a pedal concerning this invention

[Drawing 2]The perspective view of the battery concerning this invention

[Drawing 3]The sectional view showing the battery cell concerning this invention (a 1st embodiment)

[Drawing 4]The exploded perspective view showing the battery cell concerning this invention (a 1st embodiment)

[Drawing 5]The figure explaining the electrode plate concerning this invention

[Drawing 6]The top view of the collecting electrode plate concerning this invention

[Drawing 7]The sectional view explaining the method of laser welding of right and negative electrode board, and collecting electrode plate concerning this invention

[Drawing 8]The flow chart of the manufacturing process of the electrode assembly concerning this invention (a 1st embodiment)

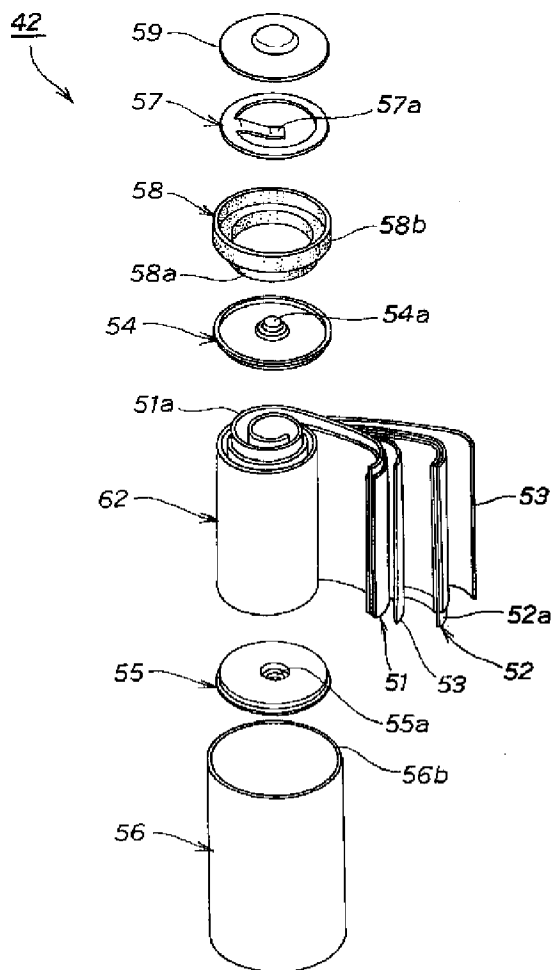
[Drawing 9]The explanatory view explaining the modification of a collecting electrode plate (a 2nd embodiment)

[Drawing 10]The explanatory view explaining another modification of the collecting electrode plate concerning this invention (a 3rd embodiment)

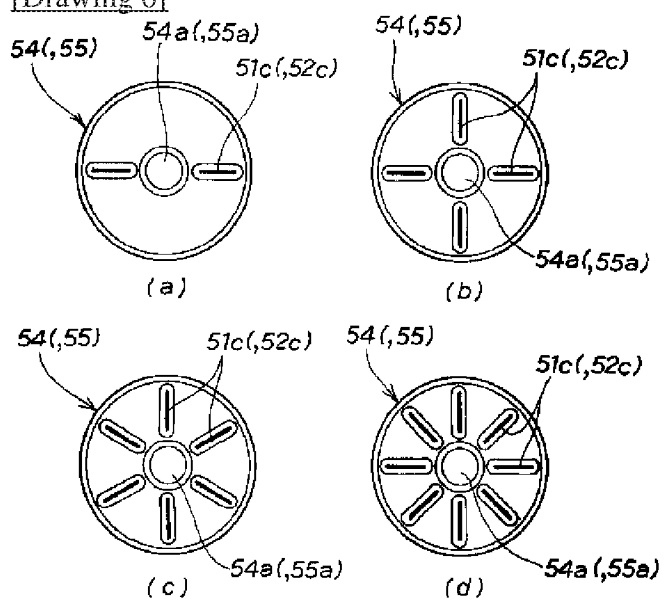
42, 66, 70 -- A storage element (battery cell), 51 -- A positive electrode board, 51b, 52b -- Active material, 51d, 52d [ -- A negative pole terminal (collecting electrode plate), 56, 73 / -- A case 62 / -- A rolled form electrode plate (electrode assembly), 64a / -- Slot (spiral slot). ] -- an unpainted portion, 52 -- A negative electrode board, 54, 64, 65, 71 -- A positive pole terminal (collecting electrode plate), 55, 64, 72

[Drawing 5]

[Drawing 4]

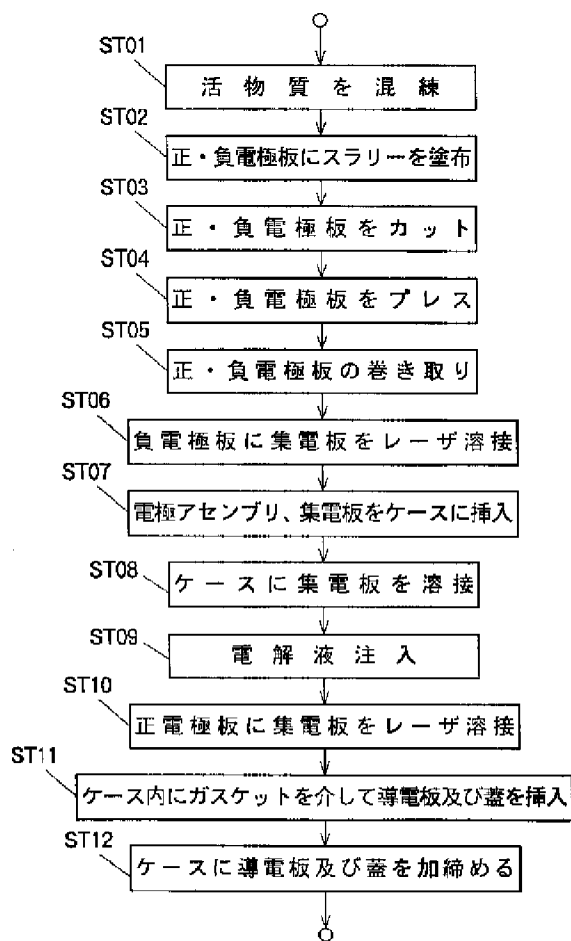


[Drawing 6]

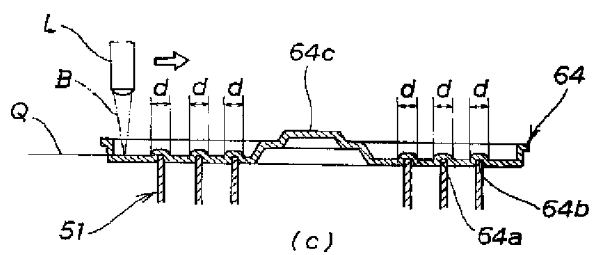
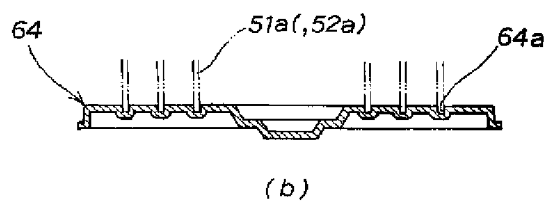
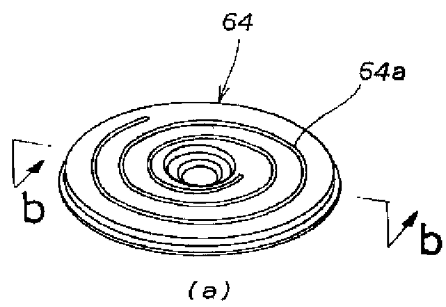


[Drawing 8]

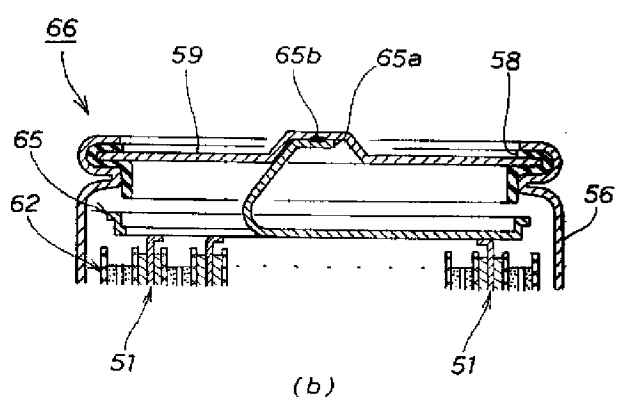
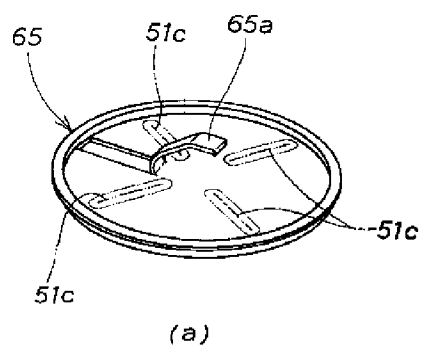




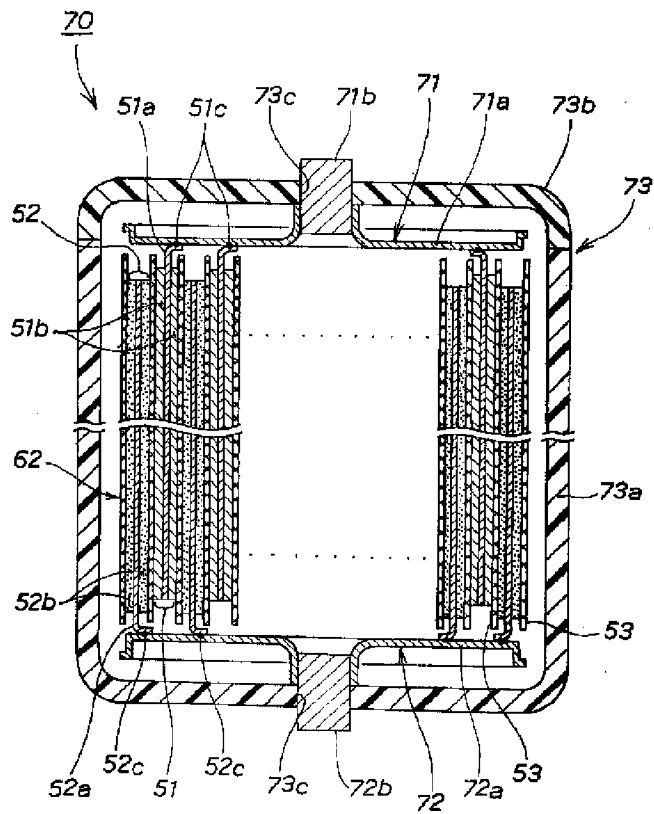
[Drawing 9]



[Drawing 10]



[Drawing 11]



[Drawing 12]

